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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/945,432	09/04/2001	Chung Liu	TS00-523	2709

28112 7590 03/31/2003

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EXAMINER
NGUYEN, HA T

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 03/31/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application	Applicant(s)
	09/945,432	LIU ET AL.
	Examiner	Art Unit
	Ha T. Nguyen	2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 February 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,6-13,17-23 and 26-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,6-13,17-23 and 26-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Notice to applicant

1. Applicant's Amendments and Response to the Office Action mailed 10-15-02 and request for a RCE has been entered and made of record has been entered and made of record (Paper Nos. 7, 9, and 10). Following is an Office Action responding to the request.

Response to Amendment

2. Applicant's arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive. The response to these arguments will be incorporated in the modified ground of rejection given below.

Claim Rejections - 35 USC § 112

3. Claims 1-3, 6-13, 17-23, and 26-31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 11, and 21 recites the limitation "performing CMP " in lines 12, 10, and 11, respectively, "depositing bonding metal patterns" in lines 13, 11, and 12, respectively, "forming a passivation layer" in lines 15, 13, and 14, respectively, it is not clear to what these steps were done.

Claims 2-3, 6-10, 12, 13, 17-20, 22, 23, and 26-31 variously depend from claims 1, 11, or 21, they are rejected for the same reason.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 2, 6-12, and 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kida et al., U.S. Patent 6313540 (Hereinafter Kida).

[Claim 1] Referring to Figs. 5, 6a-6j, 7a, 9, Kida discloses a method of forming a bonding pad that is immune to IMD cracking, comprising: providing a partially processed semiconductor wafer 11 having all metal levels completed (see Figs. 5 and 9); forming a blanket dielectric layer 15 over the uppermost metal level; patterning and etching said dielectric layer to form horizontal and vertical arrays of trenches 21 passing through said dielectric layer such that none of said horizontal trenches completely intersects any of said vertical trenches and separating said dielectric layer into cells (see Figs 7g) such that cracks will not propagate much beyond a cell before being stopped by a trench in order to limit the propagation of any cracks that may form (see abstract), the examiner interprets that each blank rectangles showed corresponds to a cell and a crack formed in a cell would be restricted to the cell by the trenches around the cell ; filling said trenches with a conducting material 23; planarizing the conducting material (see Fig. 6f) ; depositing bonding metal patterns 24; bonding wires 18 onto said bonding metal patterns; forming a passivation layer 17. But it does not disclose expressly performing CMP to planarize. However, the examiner takes Official Notice that CMP is a well known method of planarization used to obtain global planarization.

[Claim 11] Referring to Figs. 5, 6a-6j, 7a, 9, Kida discloses a method of forming a bonding pad that is immune to IMD cracking, comprising: providing a partially processed semiconductor wafer 11 having all metal levels completed (see Figs. 5 and 9); forming a blanket dielectric layer 15 over the uppermost metal level; patterning and etching said dielectric layer to form horizontal and vertical arrays of trenches 21 passing through said dielectric layer and separating said dielectric layer into cells (see Figs 7a); filling said trenches with a conducting material 23; planarizing the conducting material (see Fig. 6f) ; depositing bonding metal patterns 24; bonding wires 18 onto said bonding metal patterns; forming a passivation layer 17. But it does not disclose expressly performing CMP to planarize and that the horizontal and vertical arrays of trenches passing through said dielectric layer according to a nonintersecting layout. However, Kida also disclose that the shape of the openings 21 does not have to be square, but can have other shape (see col. 5, lines 13-42), when the openings in Fig. 7a have more elongated

shape, the non-intersecting is clearly shown. Besides, the examiner takes Official Notice that CMP is a well known method of planarization used to obtain global planarization.

[Claims 2 and 12] Kida also discloses wherein said dielectric layer is composed of materials from the set: silicon oxide, silicon nitride, silicon oxynitride (See col. 4, lines 1-5);

[Claims 6-8 and 16-18] wherein the filling of said trenches with a conducting material is accomplished using a plug process; wherein the filling of said trenches with a conducting material is accomplished using a W plug process; wherein the filling of said trenches with a conducting material is accomplished using a plug process from the set: Al plug, Cu plug, silicide plug (See col. 4, lines 6-14);

[Claims 9 and 19] wherein the width of said trenches is 0.6 micrometers (See col. 6, lines 7-11), the contact area of the pad and the via hole gives the dimension of the width of the via hole because the whole cross section of the via hole contact the pad (see Fig. 5). But it does not disclose the exact range for the width of the trenches. However any variation in width in the present claims is obvious in light of the cited art, because the changes in width produce no unexpected function. The routine varying of parameters to produce expected changes are within the ability of one of ordinary skill in the art. Patentability over the prior art will only occur if the parameter variation produces an unexpected result. In re Aller, Lacey and Hall, 105 U.S.P.Q. 233, 235. In re Reese 129 U.S.P.Q. 402, 406.

[Claim 10] Kida also discloses wherein the separation between neighboring horizontal trenches and neighboring vertical trenches is between 0.2 and 20 micrometers (See Fig. 5 and col. 6, lines 7-11) the Fig. shows that the separation between neighboring trenches is less than twice the width of the via hole, therefore, it is between 0.6 and 1.2 micrometers, a range within the claimed 0.2 and 20 micrometers range.

Therefore, it would have been obvious to use Kida teaching to obtain the invention as specified in claims 1, 2, 6-12, and 16-19.

6. Claims 1, 2, 6-9, 11, 12, 16-19, 20-22, and 26-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kida, as applied to claims 1, 2 and 6-10 above, in view of Huang et al., U.S. Patent 6236114 (Hereinafter Huang).

[Claims 1, 11 and 21] Kida discloses substantially the limitations of claims 1, 11 and 21, as shown above .

But it does not disclose expressly that the horizontal and vertical arrays of trenches passing through said dielectric layer according to a brick laying layout or a modified brick laying layout. Some may argue that the feature "a nonintersecting layout" of claim 11 is not taught or made obvious by Kida.

However, the missing limitations are well known in the art because Huang discloses these features (See Figs. 1, 2 , # 135a,b, 155a,b, 175a,b).

A person of ordinary skill is motivated to modify Kida with Huang to obtain improved adhesion between dielectric and metal layers and to more uniformly release the compressive mechanical stress (see Huang, abstract).

[Claims 2, 6-9, 12, 16-19, 22, and 26-29] The arguments used for the rejection of claims 2 and 6-9 above also apply.

[Claim 20] Kida also discloses wherein the separation between neighboring horizontal trenches and neighboring vertical trenches is between 0.1 and 10 micrometers, as shown in the rejection of claim 10. But it does not disclose expressly that the ratio between the spacing of perpendicular trenches to the spacing of parallel trenches is less then about 1/5, and the spacing of perpendicular trenches is greater than about 0.1 micrometers. However, the missing limitation is well known in the art because Huang discloses this feature (see Fig. 2).

[Claims 30 and 31] The argument for the rejection of claim 10 also applies. Besides Huang also shows that the overlap area in said modified bricklaying layout is between 0.1 and 1 of the overlap area of said bricklaying layout (see Fig. 2).

Therefore, it would have been obvious to combine Kida with Huang to obtain the invention as specified in claims 1, 2, 6-9, 11, 12, 16-19, 21, 22, and 26-31.

7. Claims 3 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kida, as applied to claims 1, 2, 6-11, 12, and 16-19 above, (or Kida in view of Huang and further) in view of Saran, U.S. Patent 6232662.

Kida (or Kida in view of Huang)discloses substantially the limitations of claims 3 and 13, as shown above.

But it does not disclose expressly that the dielectric layer is a composite of dielectric layers and the methods of forming the dielectric layers.

However, the missing limitations are well known in the art because Saran discloses these features (See col. 6, line 38- col. 7, line 4). The combined teaching of Kida (or Kida , Huang) and Saran does not disclose the use of HDP oxide. However it would have been obvious for a person of ordinary skill in the art to use HDP to obtain good quality and dense oxide.

A person of ordinary skill is motivated to modify Kida (or Kida , Huang) with Saran to obtain dielectric with low dielectric constant or material with characteristics suitable for a specific application requirements concerning manufacturing cost, product quality and equipments.

Therefore, it would have been obvious to combine Kida (or Kida , Huang) with Saran to obtain the invention as specified in claims 3 and 13.

Conclusion

8. The prior art relevant to the disclosure of this application and not being used in the rejections.
US Patent 6465895 to Park et al. for teaching the forming of vertical and horizontal trenches to prevent cracks from expanding.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706 . The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

Ha Nguyen
Primary Examiner
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